

# SAND BUNKER CONSTRUCTION

By Carl Grassl

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Bunker construction, as most superintendents know it, involves building one or more bunkers on an individual golf hole. Ideally, the interests of course architect, Superintendent, and club membership will all be satisfied upon project completion. This is a difficult goal to achieve.

An important consideration, whether establishing new bunkers, or enlarging or reshaping old ones, is the original design of the golf course. New bunkers will hopefully maintain the character of the course created by the architect. In addition, the new bunker should not upset any aspect of course maintenance. In most instances, however, course character and maintenance concerns become secondary and design is based on membership desires and committee approval. For example, if a committee objective is to challenge the low handicap golfer, the out-of-character 7,000 sq. ft. bunker will appear, extending from 210 yds. to 280 yds. off the tee. Further complications might arise if another bunker of similar size is proposed for positioning directly across the fairway, with only enough room to squeeze a 7-gang fairway mower between the two bunkers. The conflict between playability, character, and maintenance can best be resolved through consultation with an architect. His experience and expertise will lead everyone in the right direction.

Now let's talk construction, the true joy of being a Superintendent. Seriously, I feel all Golf Course Superintendents have true talents for construction, and exercise this ability whenever they have the opportunity. Sometimes it is not economically feasible, where equipment or manpower is lacking, but that is the committee's and/or Superintendent's decision. Once the site, approval, and acceptable construction timetable are established, the challenge begins. Creating a large masterful bunker from a flat surface where soil must

be brought on site, carving one out of a hill, or enlarging an existing bunker all require much advance planning and calculation. This is true whether self constructing or hiring a contractor. Shaping, drainage, and sand texture are the principal concerns. Often, a Superintendent will encounter ideas at a club which conflict with present day construction principles. At Blue Mound, for instance, it was previously believed that only the depth of sand in a bunker determined how deep the ball would penetrate. In other words, to prevent burying, only 2" of sand should lie above the final grade. It takes a patient presentation of new concepts to change such long held notions.

Construction techniques today place more emphasis on drainage, greater depths of sand, and steep squared-off wall construction all creating improved water movement. Drainage seems to be the key word when talking about consistency in bunkers, meaning when bunkers are wet they are all wet, and when they are dry they are all dry. Physical drainage (drain tile) is of utmost importance in construction. Many methods of tile installation have been attempted and are draining water very well. I have installed a herring-bone pattern using 2" unsleeved tile under 6" of sand. The bunker drained well, but the tile wanted to work its way to the surface somewhat. To date, my best luck has been with 4" corrugated plastic tile covered by a nylon sleeve, with plastic wire ties used to hold the sleeve in place at all joints along the line. The tile is laid 6"-8" below the surface of the sand. For greater speed in water exit, the spun-bound blanket can be used, lined with pea gravel with 2" or 4" tile inside, then wrapped around and sealed. My experience has indicated that drain tile installation or repair works much better after sand installation. We have found that tile should be placed in settled, compacted sand at the base of the bunker. This insures no tile movement or damage while grading or compacting sand. A trench must be hand dug through the sand; however, I feel the time is well spent considering the assurance of a stable installation which will drain water. Another key to fast,

consistent drainage is fresh, washed sand; not simply placed over old sand, but through the entire depth of the bunker. This indicates another problem— sand might have to be replaced every so many years. All of these processes fall into place in our business, and this old sand from the bunkers will be used to topdress fairway areas!!!

Self construction of a bunker has resulted in half the cost that a contractor would charge. However, it requires twice the time. For moving large amounts of soil, contractors become more practical, unless necessary equipment is readily available. Below are the actual construction costs of a fairway bunker on Blue Mound's #9. The site was flat and no additional soil was required.

SIZE: 35 yds. in length	105 ft.	
9 yds. wide	27 ft.	
(kidney shaped)	2,835 sq. ft.	
CONSTRUCTION HOURS:		
96 hrs. @ \$7/hr. end loader, back hoe, box scraper		\$672.00
DRAIN TILE:		178.00
TILE INSTALLATION:		
8 hrs. @ \$7/hr.		56.00
SOD: Bluegrass blend —		
680 yd. @ \$.70/yd.		476.00
SAND: 80.8 tons @ \$4.50/ton		363.00
		<u>\$1745.00</u>
\$1745/2,835 sq. ft. = \$.62 per sq. ft. (a little under Ray's average)		

Hiring a contractor to rough-grade and/or final grade a bunker drastically affects construction costs. Given the above bunker, assume a contractor is brought in to grade the project.

CONSTRUCTION HOURS:		
20 hrs. @ \$72/hr. dozer with front blade		\$1,400.00
DRAIN TILE:		178.00
TILE INSTALLATION:		56.00
SOD:		476.00
SAND:		363.00
		<u>\$2,513.00</u>

This would be a cost of \$.89 per sq. ft. which is 30% higher than self construction. Labor hours and costs should be noted. Hiring a contractor to complete the entire project would more than double the total cost of construction.

This newly constructed fairway bunker soon became the topic of conversation and debate among the members. No consensus could be reached concerning "correct"

bunker location, and certain players did not feel enough sand was visible from the tee. The bunker caught most well-placed drives, and the ball would be buried. Needless to say, the Superintendent's next project was to investigate possible sands for eliminating this problem. We knew coarse sands would be the solution, and many mixes were tested, including a special 1 mm mix. (This was not an acceptable sand for play.) Finally, a mix was chosen, and in the last 3 years we have utilized it in 6 new fairway bunkers. The mix contains #1 mason sand, spec. between .25mm and .84mm.

Bunker consistency varies with moisture content, and the membership desired the fairway bunkers to be firm. In fact, the feeling was that fairway bunker maintenance should be totally different from that of green bunkers in terms of frequency of raking and depth of raking. We experimented with the mechanical rake using 2 rows of teeth, 1 row of teeth, and no teeth at all. Also, we looked at shallow raking vs. deep raking. This relationship between raking and firmness sparked the idea of smoothing rather than raking with teeth or combs. We have investigated dragging rubber mats, nylon nets, rubber hoses (different sizes and shapes) filled with sand, and replacing the combs on the mechanical rake with smooth steel of different weights and at different angles. All of these attempts turned out to have drawbacks. We have not tried replacing the combs with soft rubber rollers. Hand raking has its positive and negative aspects also, and perhaps a combination of mechanical and hand raking is the answer. Raking, then watering a bunker, leaves a very desirable playing surface for a period of time.

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When one discusses bunker maintenance procedures, it is assumed that the sand is uniform and clean. Consistency cannot be maintained if soil/silt contamination has occurred, and simply adding sand does not solve the problem. Complete removal of old sand, checking and repairing/replacing drain tiles and replenishing the bunker with fresh

sand is the only answer. Unique equipment is at our disposal whether hired or rented. Machines called **Grade-all** or **Cruz-Aire** are 4-wheel drive hoes which can be very productive during the winter months. Frost in the ground prevents turf damage, and snow does not hinder performance. The bucket reach of 30' allows most bunkers to be cleaned from one location outside the bunker. This reach also facilitates loading of trucks, an important part of the operation. This is definitely a winter project, which flows well with hauling fresh sand into the bunker. The key is to grade the sand as soon as possible so it will not freeze. At Blue Mound, this has become the primary method of

bunker reconstruction. We can remain within the original architectural design, while reshaping where necessary and updating sand texture and drainage.

To sum up, quality bunker construction involves many aspects, and requires first hand inspection during all phases of the project. The membership can only be pleased if the bunker is neat, with defined edges and is noticeable. Since this is just one more hazard, praise and thanks cannot be expected. Most golfers will never land in a bunker that they like, so our satisfaction must be in the proper design, construction, and maintenance of a hazard which is always a controversial topic.

## SAND BUNKER RENOVATION

*By Larry Lennert*

Maintaining high quality playing conditions in a hazard seems more than a little bit ironic to me, but it is an irony all of us must face with sand bunker maintenance. The high level of playability we all seek cannot be maintained indefinitely with just the standard maintenance techniques of raking and edging. Sooner or later, sand bunkers need to be renovated.

Sand bunker renovation is a continuous process at North Shore Golf Club at Menasha and we renovate several of our 34 bunkers each year.

The first step in the renovation process is deciding which bunkers, if any, need renovation. Bunkers that hold water after a rain or have low quality playing conditions are good candidates. Once you have decided which bunkers need renovation, work can begin.

First, remove **all** of the old sand from the bunker. This is often the most important step in sand bunker renovation. Just adding new sand to a bunker filled with contaminated sand will not improve drainage and may actually reduce playability by building up excessive sand depths over time. This practice is nothing but a temporary fix and a waste of new sand. In the long run it has the same ef-

fect as throwing a pair of clean socks into a washer full of dirty clothes. The presence of only 5 percent silt and 3 percent clay in a sand can reduce drainage.

To remove the old sand we use a front-end loader and load the sand into one ton, dual wheel dump trucks. Most of the old sand can be removed this way. The rest of the sand is shoveled by hand into Cushman's. We have often found that just removing the old sand and replacing it with new, clean sand eliminates many of our drainage problems.

Next, check the drainage system. Replace or repair it if necessary or install one if none was there before. We use plastic drain tile and cover it with a nylon "sock" to keep sand from filling the tile. After the tile is in place we cover it with ¾ inch gravel to keep the drainage channel open and the drain tile in place. Surface drainage is also examined to make sure large amounts of water are not flowing through the bunker during heavy rains. If this is the case, we use surface contouring, where possible, to divert water away from the bunker.

After the drainage work is completed, the bottom of the bunker is shaped using a box scraper, a power rake and hand labor. The edges of the bunker are hand dug